Mechanical Design and Assembly Guidelines for SPS30

Particulate Matter Sensor

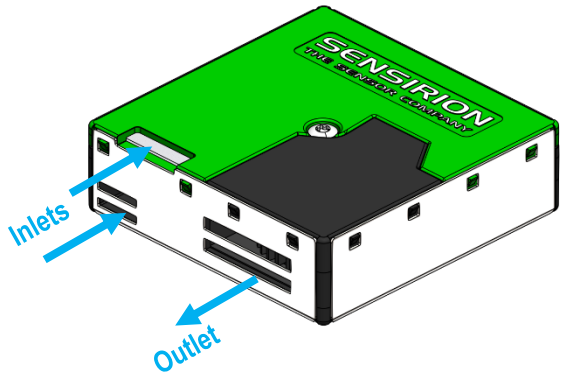
Preface

To ensure the best performance of the sensor in the end user device it is important to consider a few recommendations when designing a product using SPS30. This application note will present the main design-in and assembly guidelines for the best sensor performance.

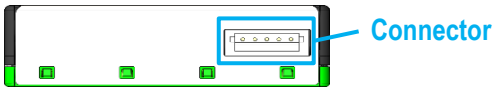
1 Package

SPS30 features two air inlets and one air outlet that should not be obstructed and should be properly coupled to ambient air. The ambient particulate matter will flow through the sensor thanks to an integrated fan, active during sensor operation. The metal casing of the SPS30 is covered in a semitransparent turquoise plastic foil to protect it during shipping. The foil has no impact on the sensor performance and thus does not need to be removed for mechanical assembly.

Sensor package



FRONT VIEW



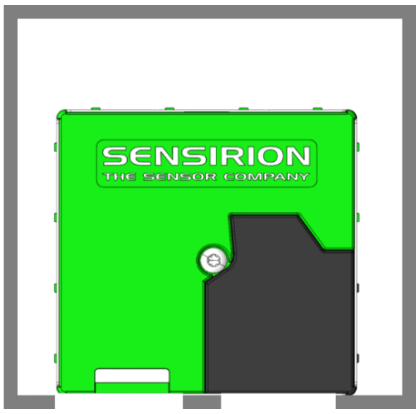
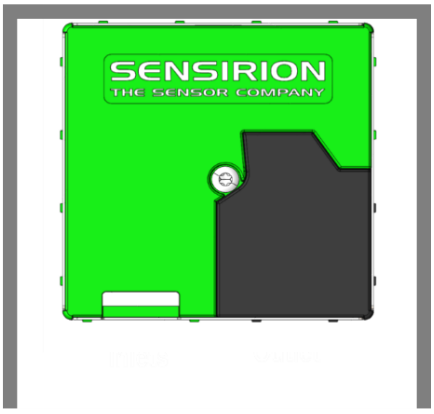
REAR VIEW

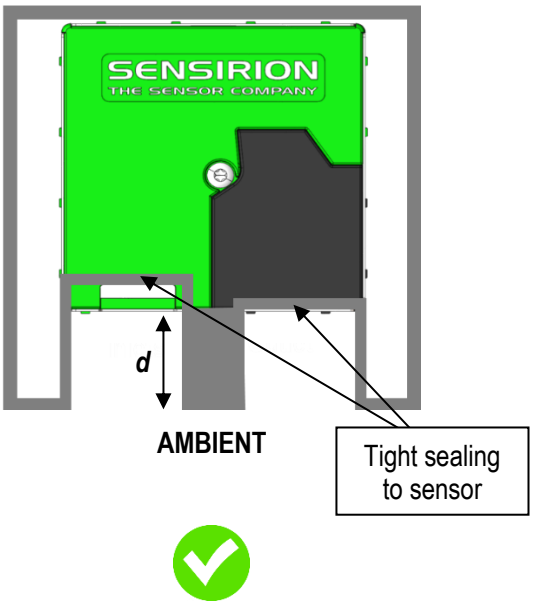
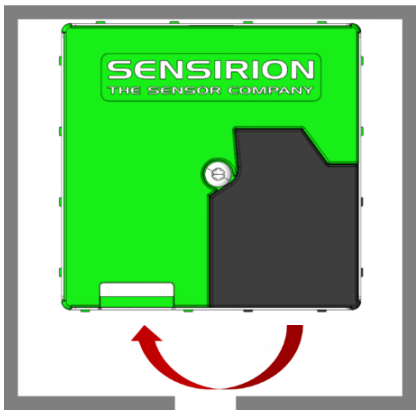
2 Placement of the Sensor

2.1 Coupling to Ambient

A good coupling of the inlets and outlet of the SPS30 to the ambient air via the device openings and a suitable device design is essential in order to accurately measure the ambient particles concentration.

Ideally, the sensor is placed as close as possible to the device's outer shell using large openings allowing the sensor to be exposed to the ambient. The larger the opening, the better the air exchange between the sensor and the ambient, resulting in faster response times. A tightly sealed separation between inlet and outlet will result in the best performance.

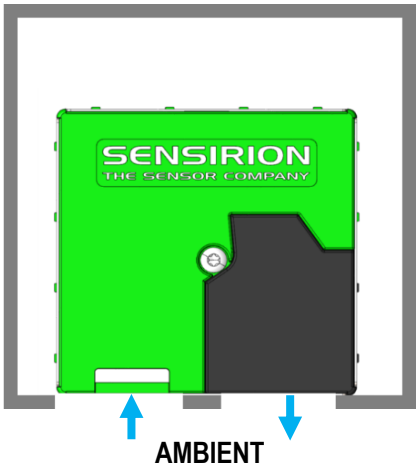
Place sensor inlets/outlet as close to the ambient as possible. Large openings are recommended.	
 **AMBIENT** ***SIDE VIEW***	 **AMBIENT** ***SIDE VIEW***

Avoid designs which will make air flow from the outlet back to the inlets.	
Separate inlets and outlet	**Inlets/Outlet should be close to the opening**
 **AMBIENT** ***SIDE VIEW***	 **AMBIENT** ***SIDE VIEW***
• Minimize depth *d* (sensor as close as possible to ambient) for fast response time • There should be no pressure difference between the two inlets and the outlet	• A constricted volume in front of inlets/outlet results in air flowing back from outlet to inlets, affecting the real measurement.

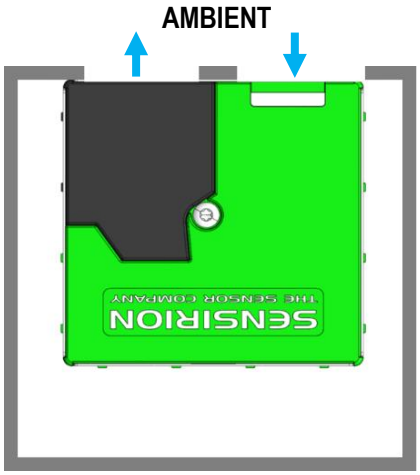
2.2 Orientation

Vertical placement

Placing the sensor with the inlets/outlet facing down avoids dust accumulation and accelerated sensor aging.



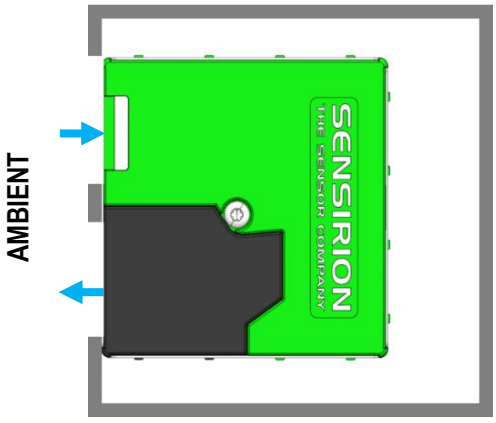
SIDE VIEW



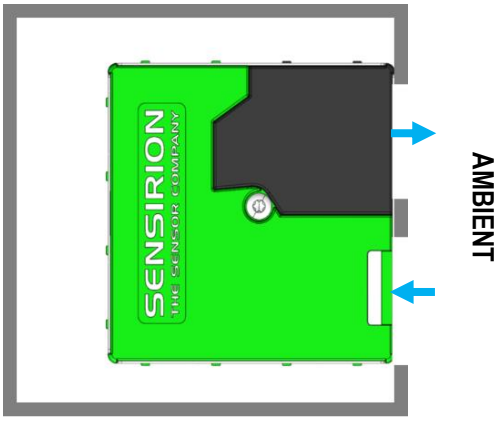
SIDE VIEW

Lateral placement

Inlets should always be above outlet to avoid particles getting back from the outlet to the inlets due to gravity.



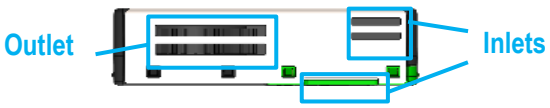
SIDE VIEW



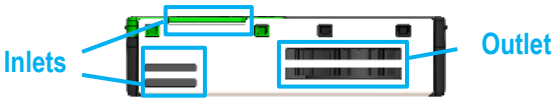
SIDE VIEW

Horizontal placement

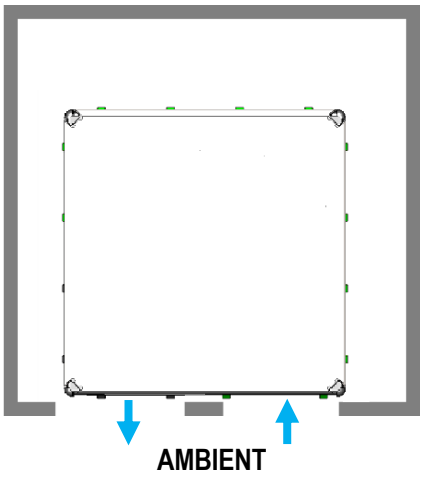
The green side marked "Sensirion" should be facing the ground for optimal performance and lifetime.



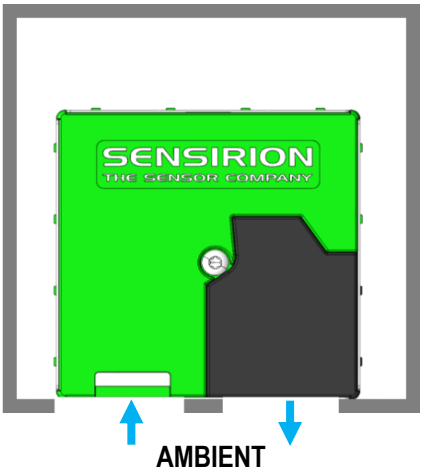
FRONT VIEW



FRONT VIEW



TOP VIEW

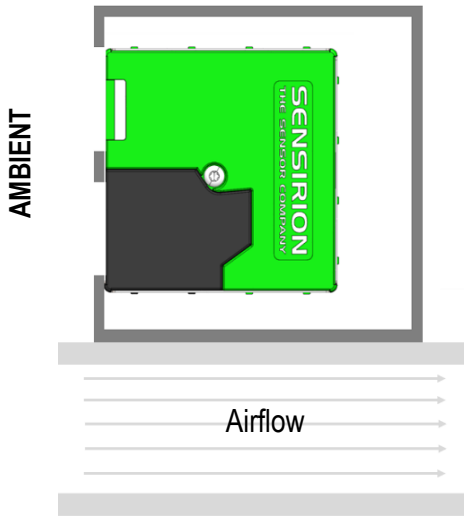


TOP VIEW

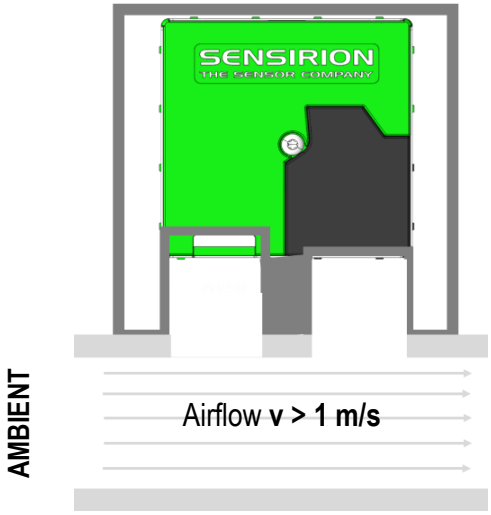
2.3 Isolation from Airflow

External airflows can generate a pressure drop between inlets and outlet and alter the sensor reading. Very strong flows can also physically prevent particles from entering the sensor inlet channels. The sensor should be isolated from the airflow of the final device (e.g., air purifier) if the velocity of this flow is greater than 1 m/s. For a design in where the external flow velocity is greater than 1 m/s contact Sensirion for more information.

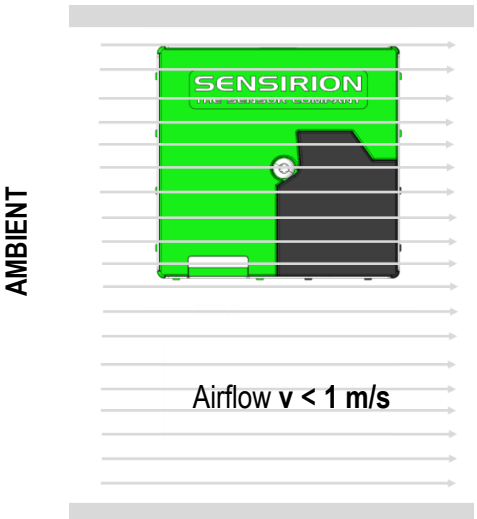
Isolate sensor from external airflows if the flow velocity is greater than 1 m/s.



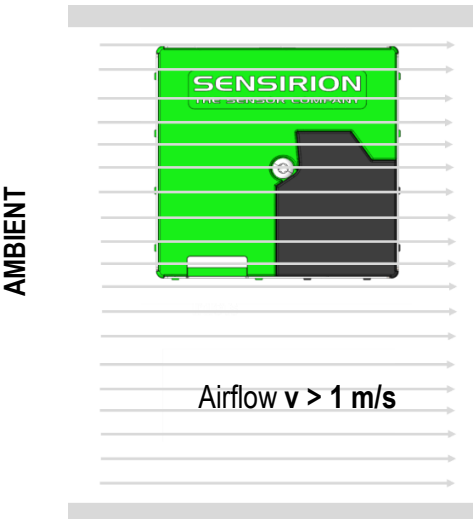
SIDE VIEW



SIDE VIEW



SIDE VIEW

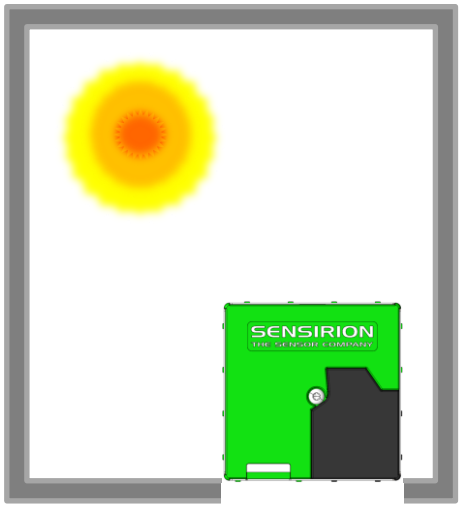
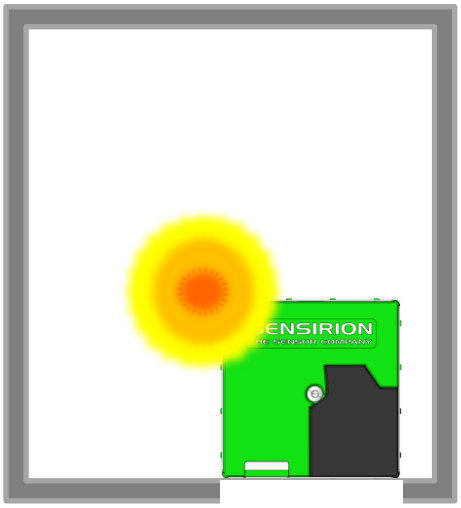


SIDE VIEW

2.4 Decoupling from External Heat Sources

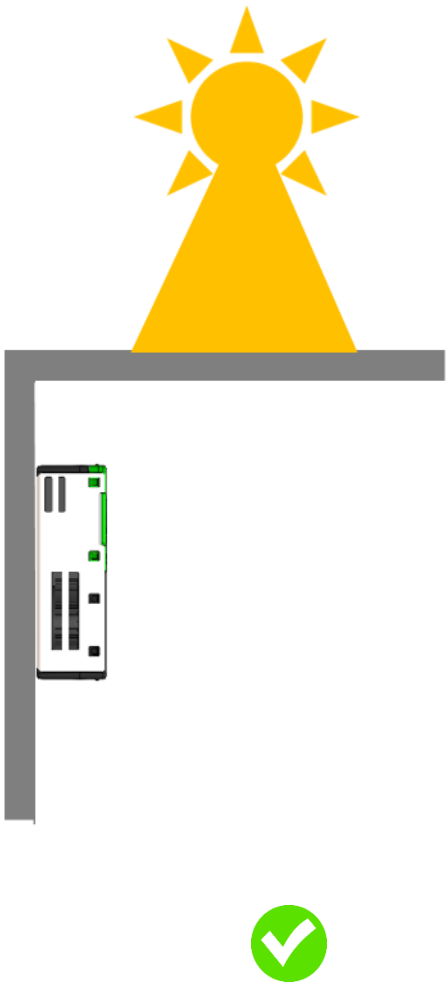
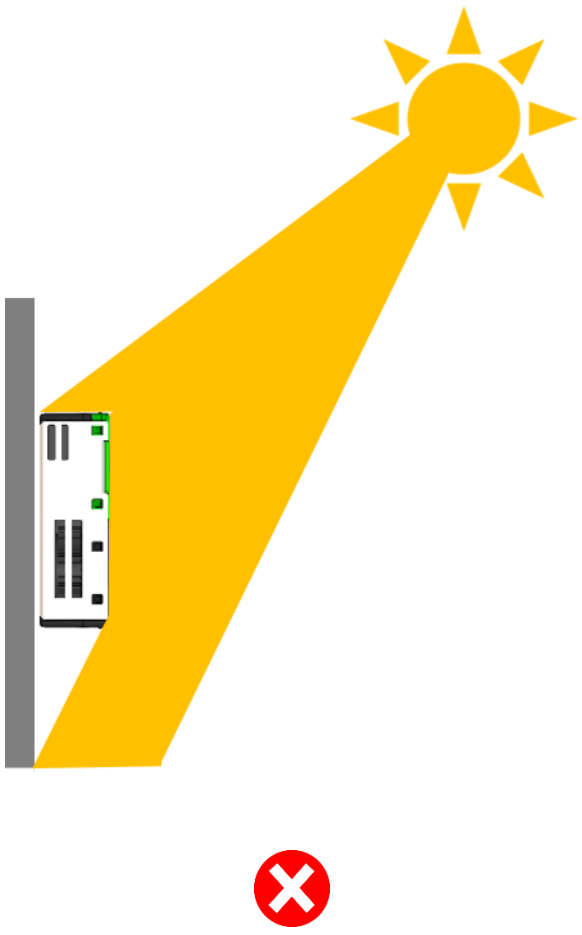
Sensirion SPS30 sensors are designed for best performance and stability at different environmental temperature conditions. However, heat sources such as external microcontrollers might induce thermal stress on the SPS30, degrading its long-term performance. To overcome related overheating effects, it should be avoided to design the SPS30 in close vicinity to heat sources.

It is further recommended to place the SPS30 below heat sources as air convection arising from heat sources might heat up the sensor.

Avoid placement of the sensor close to heat sources.	
 **AMBIENT** ***SIDE VIEW***	 **AMBIENT** ***SIDE VIEW***

2.5 Protection from Sunlight

Exposing the SPS30 to direct sunlight might introduce temperature gradients and accelerate the aging of the SPS30. Thus it is recommended to protect the sensor from direct sunlight. This can be achieved by a suitable design-in or by using a light shade.

Avoid exposure of the sensor to direct sunlight.	
 ***FRONT VIEW***	 ***FRONT VIEW***

3 Mechanical Assembly Guidelines

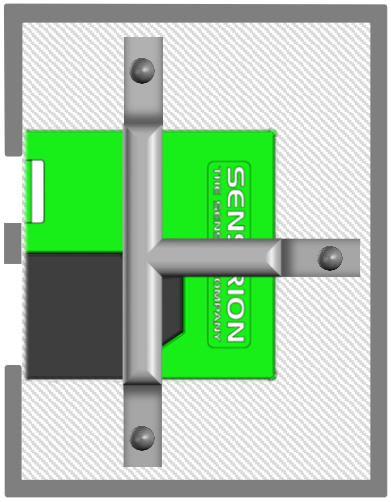
The following indications should be followed when assembling the SPS30:

- Do not obstruct inlets and outlet.
- Firm mechanical fixations should be used to reduce unwanted noise caused by loose mechanical coupling.
- Acoustic foam or thin rubber can be used to further reduce noise[1].
- If an all-around casing is used, it is recommended to not cover the entire sensor surface to avoid overheating.

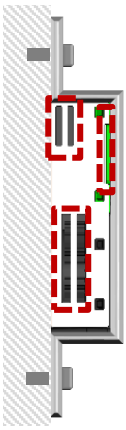
A few mounting examples are shown in the following. The red dashed-line regions show the non-obstructed inlets/outlet and connector areas.

Screws and brackets

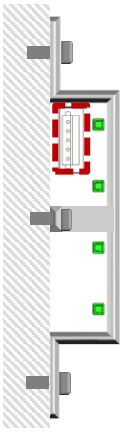
= do not obstruct



SIDE VIEW



FRONT VIEW

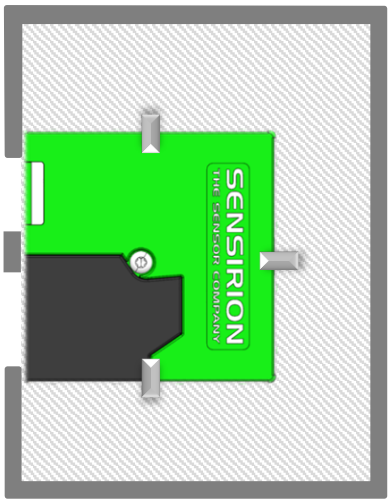


REAR VIEW

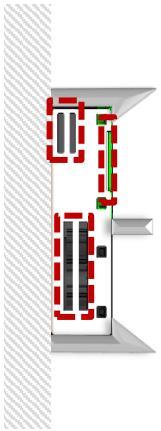
[1] Note that sensor acoustic emission level is always below 25 dB(A). Acoustic foam helps to reduce unwanted noise generated by the mechanical coupling between the sensor and the fixations.

Snaps

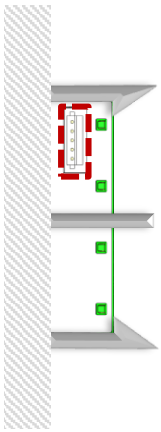
= do not obstruct



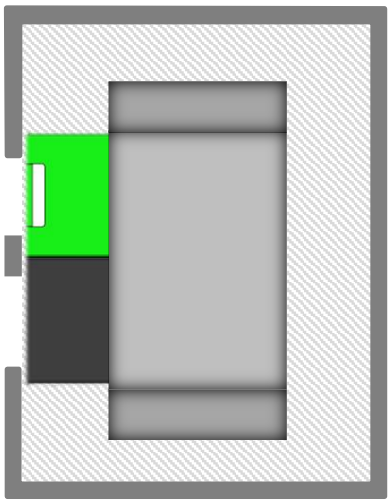
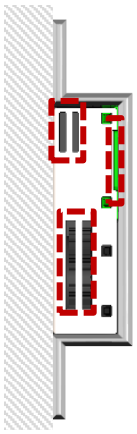
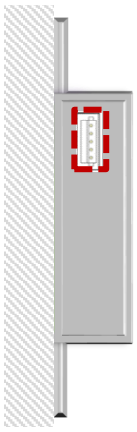
SIDE VIEW



FRONT VIEW



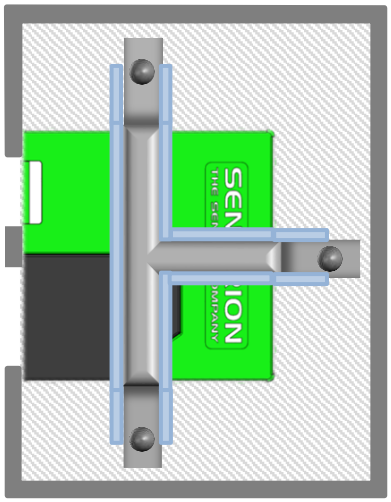
REAR VIEW

All-around	
= do not obstruct   *SIDE VIEW*	 *FRONT VIEW*
	 *REAR VIEW*

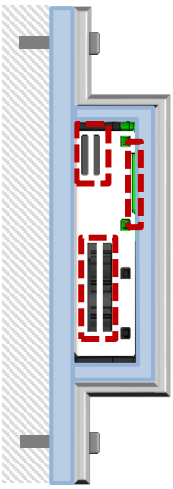
Add acoustic foam around the sensor to further reduce noise. Screws and brackets example[2].

= do not obstruct

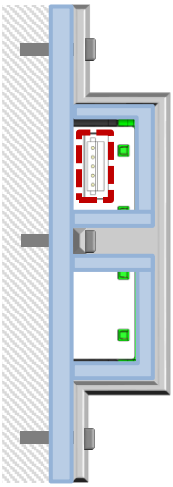
= acoustic foam



SIDE VIEW



FRONT VIEW



REAR VIEW

[2] Similarly, acoustic foam or thin rubber can be used for other suggested mechanical fixations (e.g. snaps, all-around).

Revision History

Date	Version	Page(s)	Changes
January 2019	1.0	All	Initial version

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